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AUTHOR Kennedy, Mary M.
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ABSTRACT

Three issues on teacher quality are addressed: (1) How can teachers more representative of the student population be recruited? (2) How can the intellectual calibre of prospective teachers be assured? and (3) How can teachers' actual classroom practice be improved? In discussion on the first issue, it is pointed out that with the influx of minority students, matching students and teachers by demographic characteristics cannot realistically be achieved. However, since teachers are also role models for students, recruitment of minority teachers must be actively pursued. On the issue of raising the intellectual calibre of teachers, it is noted that the current standardized testing of prospective teachers needs to be re-examined, and further exploration of alternative routes to certification should be considered. Regarding the improvement of classroom practice, two proposals are considered: developing sound and effective induction programs, and encouraging the growth of professional development schools. (JD)

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National Center for Research on Teacher Education

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Policy Issues in Teacher Education

By
Mary M. Kennedy
Director

In the United States today, we face three distinct problems of teacher quality. The first is a *representation* problem: How do we get people into the teaching force who are more representative of the population of students being taught? The second is a *tested-ability* problem: How do we assure that those who do enter teaching are of the intellectual calibre we want for our teachers? The third is an *improvement-of-practice* problem: Even if we get the right people in the door—people who are representative and capable—how can we improve their actual classroom practice?

These three problems are often confused with one another and with the separate problem of getting enough people into teaching. As a result, solutions to one problem are often assumed to be adequate for the others. I will argue below that solving a quantity-of-teachers problem will not solve any of these three problems of teacher quality. I will also argue that these three problems of quality are not the same, and that solving one will not necessarily solve any of the others. All three must be addressed and they must be addressed separately.

The paper has two sections. In the first, I describe in more detail each of the three problems. In the second, I review a sample of policy solutions that have been proposed or tried and examine them for their likelihood of success.

What Are the Parameters of these Problems?

The Representation Problem

By now the demographic projections for the next several decades are well known. The student population is changing dramatically. In the near future, Hispanics will replace Blacks as the dominant minority in this country; the total minority population will become a substantial portion of the total population; and in some states, Caucasians will become a minority group. Yet, despite these changes in the student population, our teaching population is still largely White, suburban, middle class, and female.

This is the *representation problem.*[1] Our teaching force no longer represents the population at large, and will represent it even less in the future unless we work actively to change the teaching force. We need to recruit into teaching people who better represent the students being taught.

But how serious a problem is it if we have mainly White, working class suburban females teaching high-income students, low-income students, urban students and rural students, Whites, Blacks, Hispanics, and a host of immigrants? It depends on how you define the teacher's task. After all, we have allowed, for decades, both girls and boys to be taught mainly by women. Some people might argue that it shouldn't matter

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whether the teacher and student come from culturally similar or dissimilar backgrounds *if the teacher can actively engage students with important content.* Theoretically, you shouldn't need to be the same sort of person as your students are to have an impact on them.

> "We can never completely match students and teachers by their demographic characteristics."

Furthermore, as a practical matter, we can never completely match students and teachers by their demographic characteristics. Simply from the standpoint of probabilities, many, if not most, of the 30-35 teachers a student encounters in his or her 12 years of schooling will be demographically different from the student, even if the overall population of teachers is perfectly representative of the student population. So even if we completely solved the representation problem, we would still have numerous individual teaching situations in which teacher and student come from different demographic backgrounds. So if our main concern is that minority students be able to learn school material, we should worry as much or more about the *improvement-of-practice problem* as we do about the *representation problem*, for no matter how representative the total population of teachers is, individual teachers will still need to serve students from a variety of backgrounds.

In contrast, teachers do much more than literally teach content. They also *personify* content. They stand as models for what it is like to be an educated person, to be a member of the community of scientists, writers, mathematicians, or political scientists. They also serve as ex-officio parents, guides and mentors to young people. And if we want students to believe that they themselves might one day be scientists, writers, or mathematicians, or that they might be mentors, guides, and educated people, then we need them to see diverse examples of such people, including at least one who looks like they, the students, look.

This suggests, then, that even if better representation does not always, or even often, yield matched teachers and students, it is still important that we solve the representation problem, for students are aware of the full population of teachers in their schools, not just of the teachers in their own classrooms. And they need these role models.

The Tested-Ability Problem

There is evidence that those who enter teacher education, generally speaking, score lower on tests of academic achievement than those who enter other career tracks. Moreover, there is evidence that, among those who become certified, those with lower scores are more likely to take teaching positions. And finally, those who *stay* in teaching tend to have lower academic achievement scores than those who leave after a few years. Throughout the pipeline, then, we have created a system that systematically favors the lower scoring of all possible teaching candidates.[2]

There have been numerous attempts to understand this phenomenon, but the explanations usually boil down to two: On one side, we offer poor salaries and poor working conditions to teachers, particularly relative to other kinds of employment available to college graduates; and on the other side, we are now offering many other, more attractive work opportunities to women, who have traditionally sought teaching positions. That is, in the past, we had a special kind of captive work force, a population of women who were capable of other positions but who, for a variety of cultural reasons, did not enter those other positions. Now they do, and, as a result, we have a *tested-ability problem.*

The tested-ability problem has received more attention from policymakers than either of the other two problems. They fear that, by permitting low-achieving adults to teach, we are creating a situation in which the blind are leading the blind. The statistics are reminiscent of the old George Bernard Shaw line, "Those who can, do; those who can't, teach."

The seriousness of the tested-ability problem is hard to estimate, for to some extent, we do decide, as a society, how to allocate our talent. It is also complicated by the sheer size of the teaching population. We now use about 10 percent of college-educated women and 4 percent of college-educated men as teachers; no other profession draws such a large proportion of our educated adults.[3]

If we were so successful in solving the tested-ability problem that all, or even most, of our best and brightest students went into teaching, we would soon be worrying about a tested-ability problem in business, law, medicine, or some other field. The size of the teaching force is simply too large to be filled entirely from the uppermost ranges of tested ability.

To decide how serious the tested-ability problem is in education, we need to decide two other things. First, we need to decide the level and range of tested abilities we are willing to tolerate, given the trade-offs. We need to be honest about how many high-scoring people we will want to bring into teaching when moving them into teaching means moving such people out of business, computer science, and so forth. How many high-scoring teachers do we need, and how low are we willing to permit the bottom end of the achievement score distribution to go?

Second, we need to learn more about the relationship between test scores and teaching practice. Tests measure a particular kind of intellectual ability, one that some have argued is far too narrow. A high score on an achievement test usually means you can choose the right answer to verbal analogies, logic problems, or mathematical problems when several possible answers are provided for you.

It does not necessarily mean you could solve such problems *if the right answer were not available there for you to find*. Nor does it mean that you can solve more complicated or open-ended problems where no answer is clearly best. Nor does it mean you can *explain to someone else* how to solve such problems, as teachers must do. And, finally, it doesn't mean you could *create problems for someone else to learn from*, as teachers do. Consequently, we don't know whether moderately scoring adults actually teach less well than higher scoring adults, nor do we know whether moderately scoring adults are less acquainted with the material that they actually teach.

I don't mean to suggest that tests don't measure anything useful. Obviously they do. And we do know that differences in test scores are relevant to academic pursuits as well as to a variety of other kinds of pursuits. Nor do I mean to suggest that we can get away with a population of teachers who come from the bottom of the test score distribution. What I am saying, though, is that we don't know how low a score has to be before it makes a difference *to teaching*.

So it is hard to say how serious our tested-ability problem really is. Perhaps, if we took into account the other occupations which need to draw high-scoring individuals, and if we knew more about the relationship between test scores and teaching performance, we would conclude that our tested-ability problem is not as grave as we have been supposing.

The Improvement-of-Practice Problem

Virtually all of the blue ribbon commissions that have studied education in the last decade have argued that we need a new and better kind of teaching: teaching that challenges students more than our current methods do, that expects more of students, that demands higher order thinking from them, that prepares them for the workplace of tomorrow.[4] More than previous generations, today's students must learn to work collaboratively in teams, to solve problems, to be flexible and adaptable. Yet our current teaching practices encourage students to work in isolation and compete with one another, to learn discrete facts and skills rather than to solve complex problems, and to follow fixed routines, rather than experiment with novel tasks. Preparing students for tomorrow's workplace requires a different kind of teaching.

> "Preparing students for tomorrow's workplace requires a different kind of teaching."

Moreover, since the student body itself is changing, teachers must learn not only to teach differently, but also to teach a different kind of student, one that has traditionally been alienated from schools and from academic subjects. This, then, is the *improvement-of-practice problem*.

Suppose we solve the first two problems, the representation problem and the tested-ability problem—suppose we find ways to attract people from diverse backgrounds into teaching, and we feel confident that those entering teaching have a satisfactory level of tested ability—we would still need to find ways to alter their practices, so that they teach in a different way than teachers are now teaching, for solving these

other two problems offers us no guarantee that teaching practice will change. How can we gauge the importance of the improvement-of-practice problem? Let's look at some recent research findings.

First, national assessments in virtually every subject indicate that, although our students can perform basic skills pretty well, they are not doing well on thinking and reasoning. American students can compute but they cannot reason through complex mathematical problems.[5] They can write complete and correct sentences, but cannot prepare arguments.[6] They cannot reason through scientific problems very well.[7] Moreover, in international comparisons, American students are falling behind not only students in European countries, but behind those in many third world countries as well, particularly in those areas that require higher order thinking, problem solving, or conceptual work. Our students are not doing well at thinking, reasoning, analyzing, predicting, estimating, or problem solving. That is our first finding from research.

Our second finding gives us a clue as to why we have this first finding: Textbooks in this country typically give no attention to big ideas, offer no analysis, and pose no challenging questions. Instead, they provide a tremendous array of information, or "factlets," with questions requiring only that students be able to recite back the same empty list of facts. In fact, our textbooks often don't even provide much in the way of organization or coherence for these facts.[8] So whatever real under-standing students get about the subjects, whatever intellectual challenge they get, must come from their teachers.

But our third finding from research is that teachers teach most content only for exposure, not for understanding.[9] That is, their aim is not to assure that students really understand the concepts they present, but rather only that they have been *exposed* to it. And our fourth finding is that teachers tend to avoid thought-provoking work and activities and stick to predictable routines. Why? Because students are easier to manage and student outcomes easier to control when the tasks are routine.[10]

So, if we were to describe our current K-12 education system, we would have to say it provides very little intellectually stimulating work for students and that it produces students who are not capable of intellectual work. These problems are not, of course, all due to bad teaching. I have already pointed out that American textbooks often don't provide intellectually defensible material, and I should add now that many features of school organization and school policy can yield these results as well. Still, these findings about what happens in American classrooms help explain the findings from national and international assessments, and they demonstrate why we face an *improvement-of-practice problem.*

But our fifth finding is that people who teach are highly likely to teach in the way they themselves were taught.[11] Here's why: If your elementary school teacher presented mathematics to you as a set of procedural rules with no substantive rationale, you are likely to think that this is what mathematics is and that this is how mathematics should be studied. And you are likely to teach it this way. If you studied writing as a set of grammar rules rather than as a way to organize your thoughts and to communicate ideas to others, then this is what you will think writing is and this is how you will think it should be taught and learned.

"We learn about teaching throughout our lives."

We all learn about teaching throughout our lives. From kindergarten through twelfth grade we observe teachers. Those of us who go on to college observe even more teachers, and these teachers are not necessarily any better or different than those encountered earlier.[12] By the time we receive our bachelor's degree, we have observed teachers and participated in their work for up to 3060 days. In contrast, teacher preparation programs usually require something in the neighborhood of 75 days of classroom experience. What could possibly happen during these 75 days to significantly alter the practices learned during the preceding 3060 days?

The improvement-of-practice problem boils down to this: If we know that teachers are highly likely to teach as they were taught, and if we are not satisfied with the way they were taught, how, then, can we help them develop different teaching strategies? And how can we create schools and policies that support their use of these strategies?

How serious is the improvement-of-practice problem? I would say it is very serious. We are caught in a vicious circle of mediocre practice modeled after mediocre practice, of trivialized knowledge begetting more trivialized knowledge. Unless we find a way out of this circle, we will continue recreating generations of teachers who will in turn recreate generations of students whom we already know are not prepared for the kind of information/ technological society we are entering.

The good news is that it is possible to learn more from teacher education than people have tended to learn from it in the past. We know more now about what is involved in teaching higher order thinking than we did even 10 years ago, and we know more about the nature of knowledge teachers need than we did 10 years ago.[13] Teacher educators are now experimenting with ways of getting more out of their candidates' classroom time.[14] One way they do this is through assignments that force their candidates to be more analytic about what they see in classrooms—to raise questions about what is being taught and what is being learned, and to generate hypotheses about better ways to do it. Teacher educators are also experimenting with ways of helping candidate teachers develop alternative teaching strategies.

What Can Be Done About These Three Problems?

I argued earlier that solving one of these problems would not necessarily solve either of the others. Getting a more representative population of teachers won't assure that we get higher tested ability in our teachers; getting higher tested ability among our teachers won't assure that we get different and better teach*ing*, and helping teachers learn to teach better won't assure that we get a more representative population of teachers to serve our diverse student population.

Each problem has its own etiology and each requires its own solution. I emphasize this now because my next task is to look at some of the solutions that have been proposed, and in doing so I want to emphasize that some of the most popular solutions may not solve the problems they are supposed to solve.

The Representation Problem

The most immediately obvious solution to the representation problem is to offer financial assistance programs to help minorities and low-income students get through college. Note that these, by themselves, don't assure that any of the beneficiaries will actually enter teaching. For, just as new employment opportunities have opened up for women, so have they opened up for minorities. Offering college financial aid alone, then, won't necessarily solve the representation problem.

Another idea, now being considered by Congress, is to revive some form of Teacher Corps program. The original Teacher Corps, initiated in the 1960s, provided financial assistance during college to encourage students to teach in low-income areas for some period of time after graduation.[15] The idea is analogous to the Peace Corps: You don't assume these teachers will remain in these schools forever, but you give them an incentive to work there at least for a short time.

The original Teacher Corps program was designed to solve both a quantity problem and a representation problem—it was intended to get more people into certain classrooms as well to change the kind of person who came through the door. Some Teacher Corps programs funded students while they were in college and encouraged them to go into teaching; some solicited liberal arts graduates and gave them graduate preparation in teaching. All sought candidates who came from low-income neighborhoods in the hope that they would return to those neighborhoods. Whether a new Teacher Corps program could accomplish this outcome, given the new job opportunities for minorities, is not clear.

Such a program could, incidentally, also be used to solve our tested-ability problem if program eligibility were to depend on a particular test score. Note, though, that even if a new Teacher Corps program helps with both the representation problem and the tested-ability problem, it would not necessarily solve the improvement-of-practice problem.

The Tested-Ability Problem

The most popular solution to the tested-ability problem is to build some form of test into state requirements for certification. Virtually every state now includes some

form of teacher assessment in its certification requirements.[16] These assessments vary considerably from state to state, but regardless of their particular features, most are intended to improved the tested ability of the teaching population. Some may accomplish that goal, but most probably won't. Here's why:

In order for a state assessment to really raise the tested ability of teachers entering the work force, it would have to satisfy three conditions: First, the test would have to be a serious test—one that included intellectually rigorous content and that had a rigorous cut-off score. Second, it would have to be designed so that a lot of people failed it. If no one fails the test, then it can't, by definition, be *raising* the tested ability of new teachers.

And finally, it would have to pass legal criteria for job relevance, for as soon as very many people fail an entrance test, the state will face a lawsuit challenging the relevance of both the content and the cut-off score to the tasks of teaching. So far, no state has been able to demonstrate job relevance.[17] In addition, to avoid these lawsuits, most states design their assessments so that very few teachers will fail; that is, they adopt relatively high cut-off scores and they provide ample opportunities for those who do fail to try again. Consequently, no state assessment systems really contribute to solving the tested-ability problem. In the end, these programs serve more of a symbolic than a real function.

Another popular solution to the tested-ability problem is the alternative route into teaching. Thirty-three states now have provisions for some form of alternative route to certification.[18] What this means is that the state drops its normal requirements for obtaining a teaching credential and permits certain individuals to enter teaching through some alternative route.

States offering alternative routes to certification generally hope to attract more capable people into teaching in this way. Their reasoning is that people with high tested ability were, as college students, either deterred from teaching by its curriculum requirements or attracted to higher salaries in other career lines. In either case, they may have second thoughts later in life. So the state offers a way to become certified without having to go back to college and take a lot of courses.[19]

We are starting to get some evidence now about who enters teaching through alternative routes. Unfortunately, the evidence suggests that these new recruits do not differ substantially from conventional teacher-education graduates in their tested ability.[20] Many of the people who acquire certification through these sanctioned loopholes have been teaching already in private schools where certification is not needed, and are now seeking more lucrative positions in public schools. Others are new college graduates with roughly comparable grades as graduates who are already certified. Even those who move into teaching from other jobs are moving from lower status technical and clerical jobs more than from higher status business and science jobs.[21]

One surprising finding, however, is that alternative routes are attracting a more diverse population into teaching. Some alternative routes, for instance, are bringing more males and minorities into teaching than traditional teacher education programs do.[22] So even if this solution doesn't work well for the tested-ability problem, it may help solve the representation problem. This is one of the reasons why I emphasize the need to think about each problem separately.

Another reason I emphasize thinking about these problems separately is that policymakers often confuse the tested-ability problem and the improvement-of-practice problem. They assume that if alternative routes solve the tested-ability problem, they also *automatically* solve the improvement-of-practice problem—that there is a strong relationship between tested ability and improvement of practice.

> "Have you ever heard someone say, 'He is so smart, I don't understand a word he says?'"

There are two reasons to doubt this assumption. Have you ever heard someone say, "He is so smart, I don't understand a word he says?" Surely, that is not the kind of high-ability person we want in our classrooms. Knowing a lot, or being smart, is not enough for teaching, since the main job of the teacher is to *get someone else* to know a lot and to be smart. That is one reason to doubt that raising the tested ability of teachers will, by itself, improve teaching practice.

The second reason for doubt is one I have already mentioned: Teachers acquire seemingly indelible imprints of teaching from their own experiences as students, and these imprints are tremendously difficult to shake. The dominating impulse in any new teacher is to imitate the behaviors of his or her own early teachers. And this impulse will remain strong unless teachers are offered an equally strong and compelling alternative approach to teaching.

Most alternative route programs offer only short-term training for new teachers. They are not designed to shake loose the imprints teachers arrive with, but instead to *capitalize* on them. They expect their candidates to already know what teaching is all about, both because they are smart and because have observed teaching for some 3000 days. With only brief pedagogical training, alternative route candidates would be more likely to emulate the practices they observed as children—the familiar practices that seem almost second nature—than to develop new approaches to teaching. Even if alternative routes do raise the tested ability of teachers, then, or bring more minority teachers into teaching, they are not likely to improve teaching practice significantly. So let us now consider some proposed solutions for that problem.

The Improvement-of-Practice Problem

The most popular solution to the improvement-of-practice problem these days is the induction program. Thirteen states now require some form of induction program beyond student teaching. By this I mean that school districts are required to provide first-year teachers with some sort of guidance or assistance.[23] Often this assistance appears in the form of an experienced teacher who serves as a mentor to the new teacher. There are numerous variations on this theme. Mentors can work independently in one-on-one relationships or they can provide a standardized orientation to all newcomers. Districts can provide release time for mentors or can expect them to provide assistance in the cracks between classes.

But, like alternative route programs, induction programs will probably not *alter* practice. They will help new teachers learn what the current population of teachers knows; they will not help them learn new or different approaches to teaching. If anything, induction programs further reinforce the same kind of teaching we already have—the kind that emphasizes facts and skills rather than reasoning and analysis, passivity and compliance rather than active engagement with subject matter.

The second proposal often put forward to solve the improvement-of-practice problem is the *professional development school*.[24] There was a time when most colleges of education operated "lab schools" in which their student teachers received some practical experiences. It might be easy to say that professional development schools are a newer version of the same thing. And in many respects they are. But in one important respect they are not: The lab school was operated by the university, not by the community, and its students tended to be faculty offspring. Lab schools prepared teachers in a sort of ivory-tower environment: no poverty, no uneducated parents, few children from culturally different backgrounds, and often plenty of resources.

Professional development schools (PDSs), in contrast, are genuine collaborations between the university and the school. They serve the children who attend public schools, not those who attend private schools. Moreover, their reason for being is not just to provide a context for new teachers to learn to teach, but instead to allow *all* teachers to learn more about teaching. In that sense, they are truly laboratories.

Not many true professional development schools exist now, so I can only describe here their idealized features. One is that university faculty would teach regularly in these schools. Another is that teachers from these schools would teach regularly at the university. A third feature is that virtually everyone associated with a PDS—faculty, teachers, and student teachers—would be experimenting with new ways to teach children. And finally, the staffing patterns of PDSs and the physical layout of PDSs would look different from regular schools. They would contain private places for teachers to plan and design new strategies and materials, conference rooms where teachers could work together on new ideas, and observation rooms connected to classrooms so that teachers, teacher candidates, and other visitors could observe these teaching practices without disrupting the activity itself.

Getting a sense of the layout and the kind of work that occurs in these places should indicate some of the staffing changes that would have to occur as well, for we cannot have genuine experimentation in the typical egg-carton school organization, where each teacher is tied to one group of children for the entire day every day. Yet someone must be with these children

throughout the day, and the children must be learning throughout the day. To get a professional development school going, then, we would need to either double the existing staff, be very creative in grouping students and teachers, or draw a new cadre of teaching assistants into the school to free teachers to do the kind of experimentation and development that is needed.

This proposal is clearly designed to contribute to the improvement of practice. It does nothing for the representation problem or for the tested ability problem. And since this is the only serious solution being proposed to solve the improvement of practice problem, investing in such schools is worth a shot.

Conclusion

My aim has not been to provide an exhaustive list of policy options and their relative merits, but instead to offer a strategy for evaluating ideas that are promoted to improve the quality of teaching. There are two important parts to my argument. First, we face at least three distinct problems in this country with respect to teacher quality. We may argue about the degree to which each of these represents a problem, about which is the most important problem, and about how to solve each problem, but virtually everyone agrees that all three of these problems exists.

The second part of my argument is that solving any one of these problems will not automatically solve either of the others. This second point is particularly important, for there is a tendency among policymakers to assume that if they alter the population who *enter* teaching, they will also automatically alter the *practice* of teaching. The changing economy and the evidence from assessments both suggest a significant need to improve actual teaching practices, yet research suggests that teachers are highly likely to teach as they themselves were taught. So changing the population of people who enter the profession is not likely to change the way they teach in classrooms. Each problem requires its own separate attention.

Notes

[1] The American Association of Colleges for Teacher Education has documented these trends in *Teaching teachers: Facts and figures* (1987, Washington, DC: Author) and has developed a strong set of policy initiatives related to it. See its publication, *Minority teacher recruitment and retention: A public policy issue* (1987, Washington, DC: Author), for a discussion of both statistics and policy options.

[2] A great deal has been written in an effort to sort out the flow of talent into and away from teaching. Three good overview pieces are P. C. Schlechty and V. S. Vance (1983), Recruitment, selection and retention: The shape of the teaching force. *Elementary School Journal, 83*, 469-487; D. H. Kerr (1983), Teaching competence and teacher education in the United States, in L. S. Shulman and G. Sykes (Eds.), *Handbook of teaching and policy* (New York: Longman, pp. 126-149); and S. D. Robertson, T. Z. Keith and E. B. Page (1983), Now who aspires to teach? *Educational Researcher, 12*(3), 13-21.

[3] J. Lanier. (1986). Research on teacher education. In M. C. Wittrock (Ed.), *Handbook of research on teacher education* 3rd. ed. (New York: Macmillan, pp. 527-569).

[4] Aspects of this argument can be found in a wide range of places. For instance, the Carnegie Forum on Education and the Economy (1986) refers to it in *A nation prepared: Teachers for the 21st century* (New York: Author), which specifically addresses the problem of teacher quality; the National Commission on Excellence in Education (1983) refers to it in *A nation at risk* (Washington, DC: Author), which addresses mainly the quality and rigor of American secondary education; the National Research Council (1989) refers to it in *Everybody counts: A report on the future of mathematics education* (Washington, DC: National Academy Press), which addresses the issue of mathematics education in particular; and the Holmes Group (1986) refers to it in *Tomorrows' teachers* (East Lansing: Michigan State University: Author), which addresses both teacher education and the attractiveness of the workplace to teachers.

[5] C. C. McKnight, F. J. Crosswhite, J. A. Dossey, E. Kifer, J. O. Swafford, K. J. Travers, and T. J. Cooney (1987), *The underachieving curriculum: Assessing U. S. school mathematics from an international perspective* (Champaign, IL: Stripes Press).

[6] A. N. Applebee, J. A. Langer, I. V. S. Mullis, and L. B. Jenkins (1990), *The writing report card, 1984-88* (Princeton, NJ: Educational Testing Service).

[7] International Association for the Evaluation of Educational Achievement (1988), *Science achievement in seventeen countries: A preliminary report* (New York: Pergamon).

[8] For a review of research on school textbooks, see H. Tyson and A. Woodward (1989), Why students aren't learning very much from textbooks. *Educational Leadership, 3*(11), 14-17.

[9] See A. Porter (1989), A curriculum out of balance: The case of elementary school mathematics. *Educational Researcher, 18*(5), 9-15.

[10] Walter Doyle has been one of the main investigators in this area. See W. Doyle (1983), Academic work. *Review of Educational Research, 53*(2), 159-199; Doyle (1986), Content representation in teachers' definitions of academic work. *Journal of Curriculum Studies, 18*(4), 365-379; and Doyle and K. Carter (1984), Academic tasks in classrooms. *Curriculum Inquiry, 14*, 129-149.

[11] The reasons for this have been articulated several places. See M. Haberman (1985), Can common sense effectively guide the behavior of beginning teachers? *Journal of Teacher education, 36*(6), 32-35; D. Lortie (1975), *Schoolteacher* (Chicago: University of Chicago Press); and S. F. Nemser (1983), Learning to teach, in L. S. Shulman and G. Sykes (Eds.), *Handbook of teaching and policy* (New York: Longman, pp. 150-170).

[12] For a review of the nature of college-level teaching in a variety of academic subjects, see G. W. McDiarmid, The liberal arts: Will more result in better subject matter understanding? *Theory Into Practice, 29*, 21-29.

[13] Much of this development has occurred through the work of Lee Shulman and his colleagues at Stanford University and the work of the National Center for Research on Teacher Education (NCRTE) Michigan State University. And some professional associations, such as the National Council for Teachers of Mathematics and the National Council of Teachers of English, are now incorporating these new ideas into their teaching standards. Some illustrative works from Stanford include L. S. Shulman (1987), Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*, 1-22 and S. Wilson, L. S. Shulman, and A. E. Richert (1987), "150 different ways" of knowing: Representations of knowledge in teaching, in J. Calderhead (Ed.), *Exploring teacher thinking* (Eastbourne, England: Cassell pp. 104-124). From the NCRTE are M. Kennedy (Ed.), *Competing visions of teacher knowledge* (East Lansing: Michigan State University, National Center for Research on Teacher Education); G. W. McDiarmid, D. L. Ball, and C. W. Anderson (1989), Why staying ahead one chapter doesn't really work: Subject-specific pedagogy, in M. Reynolds (Ed.), *The knowledge base for beginning teachers* (New York: Pergamon, pp. 193-205); and D. L. Ball (in press), Research on teaching mathematics: Making subject matter part of the equation, in J. Brophy (Ed.), *Advances in research on teaching* (Greenwich, CT: JAI Press, Vol. 2).

[14] For examples of such work, see P. Schramm, S. Wilcox, P. Lanier, and G. Lappan (1988), *Changing mathematical conceptions of preservice teachers: A content and pedagogical intervention* (East Lansing: Michigan State University, National Center for Research on Teacher Education, Research Report 88-4); S. Feiman-Nemser, G. W. McDiarmid, S. L. Melnick, and M. Parker (1989), *Changing beginning teachers' conceptions: A description of an introductory teacher education course* (East Lansing: Michigan State University, National Center for Research on Teacher Education, Research Report 89-1); and D. L. Ball (1988), Unlearning to teach mathematics. *For the Learning of Mathematics, 8*(1), 40-48.

[15] For purposes of this discussion, I am describing a few general ideas. For a more detailed discussion of a variety of other approaches to the representation problem, see the American Association of Colleges of Teacher Education (1987), *Minority recruitment and retention: A public policy issue*. (Washington, DC: Author).

[16] For details, see the Council of Chief State School Officers (1988), *State education indicators, 1988* (Washington, DC: Author).

[17] For a history of the legal precedents in this area, see M. W. McDonough, Jr. and W. C. Wolfe, Jr. (1988), Court actions which helped define the direction of the competency-based testing movement. *Journal of Research and Development in Education, 2*(3), 37-43. For an example of a report questioning the validity of such assessments, see B. Horner and J. Sammons (1987), *A NYPIRG Report: The test that fails* (New York: New York Public Interest Research Group, Inc.).

[18] See Emily Feistritzer's report, *Alternative teacher certification: A state-by-state analysis 1990* (Washington, DC: National Center for Educational Information).

[19] Two recent reviews of current alternative route programs are N. Adleman (1986), *An exploratory study of teacher alternative certification and retraining programs* (Washington, DC: Policy Studies Associates) and N. Carey, B. S. Mittman, and L. Darling-Hammond (1988), *Recruiting mathematics and science teachers through nontraditional programs: A survey*. (Washington, DC: The Rand Corporation).

[20] Few studies actually examine the premises of these programs; most look instead at the number and biographical backgrounds of recruits. Two studies sponsored by the National Center for Research on Teacher Education, however, did examine the test scores and grade point averages of alternative route candidates. One is K. Zumwalt, G. Natriello, A. Hansen, and A. Frisch, *Everybody into the pool: Characteristics of entering teachers in New Jersey* (paper presented at the annual meeting of the American Educational Research Association, San Francisco, March 1987). The other is T. Stoddart, *Who is entering alternate routes into teaching and what views do they bring with them?* (paper presented at the annual meeting of the American Educational Research Association, San Francisco, March 1987). Stoddart found that grade point averages, for instance, were relatively high among alternative route English teachers but were relatively low among alternative route mathematics teachers. Based on data from the American Association of Colleges of Teacher Education (AACTE), I would guess that these English teachers have GPAs a bit above those of traditional teacher education graduates, whereas the math teachers have GPAs a bit below those of traditional teacher

education graduates. See also AACTE (1987), *Teachers and teaching: Facts and figures* (Washington, DC: Author).

[21] For a summary of findings from 64 alternative route programs see Linda Darling-Hammond, Lisa Hudson, and Shiela N. Kirby (1989), *Redesigning teacher education: Opening the door for new recruits to science and mathematics teaching* (Washington, DC: The Rand Corporation).

[22] Darling-Hammond et al., ibid.

[23] For a discussion of the purposes of induction programs, see P. C. Schlechty (1985), A framework for evaluating induction into teaching. *Journal of Teacher Education*, *36*(1), 37-41.

[24] For further discussions of these schools and their role in improving teaching, see The Holmes Group (1986), *Tomorrow's teachers* (East Lansing: Michigan State University, Author); M. Levine (Ed.), (1988), *Professional practice schools: Building a model* (Washington, DC: American Federation of Teachers); and A. Lieberman (Ed.), (1989), *Building professional cultures in schools* (New York: Teachers College Press).

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NCRTE

Michigan State University
National Center for Research
on Teacher Education
College of Education
116 Erickson Hall
East Lansing, MI 48824-1034

Non-Profit Organization
U. S. POSTAGE
PAID
East Lansing, Michigan
PERMIT NO. 21

Maureen Roberts
Acquisitions Department
ERIC Suite 400
Processing & Ref Facility
2440 Research Boulevard
Rockville MD 20850-3238